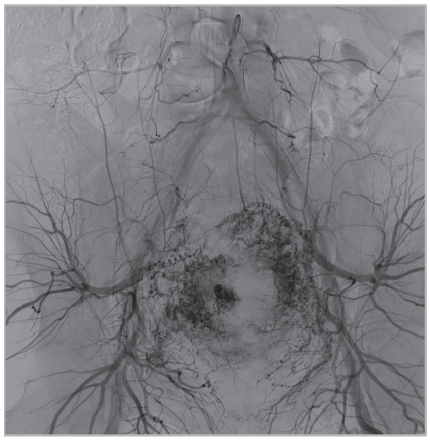
Uterine artery embolisation in symptomatic patients with placenta accreta spectrum disorders

David Brustman[1], Jan Raupach[1,2], Vendelin Chovanec[1], Pavel Ryska[1,2]

Objectives. Postpartum haemorrhage is the most common cause of mortality among women after childbirth. Therefore, this work aims to highlight the possibility of endovascular treatment of postpartum haemorrhage due to remnants in patients with placenta accreta spectrum disorders (PAS disorders) using selective UAE after failure of the standard management. This procedure is a relatively safe and technically nondemanding, with a low risk of recurrent vaginal bleeding.
Materials and Methods. This article presents an evaluation of the results of eight patients (age between 19–39 years) who underwent selective transarterial embolisation of uterine arteries from January 2022 to August 2023 at the angio-interventional department of our university hospital center. Based on a multidisciplinary consensus of sonographically detected residues of placenta accreta with typical hypervascularisation, unilateral/bilateral embolisation of the uterine artery was performed with a microcatheter using polyvinyl alcohol embolisation particles, possibly in combination with gelatine foam.
Results. There were no periprocedural complications during embolisation, nor were there episodes of repeated bleeding or other postprocedural complications during the follow-up. Two patients underwent surgical revision of the uterine cavity with extirpation of devascularised residual tissue.
Conclusions. Thus far, this procedure has proven to be a safe and relatively technically nondemanding method supplementing the management of symptomatic patients with PAS disorders with a low risk of rebleeding.

UTERINE ARTERY EMBOLISATION IN SYMPTOMATIC PATIENTS WITH PLACENTA ACCRETA SPECTRUM DISORDERS



Material and Methods

This study evaluated eight patients aged 19–39 years who underwent selective uterine artery embolisation (UAE) for postpartum hemorrhage due to placenta accreta spectrum (PAS) disorders between January 2022 and August 2023. All patients presented with vaginal bleeding after delivery, confirmed by transabdominal and transvaginal ultrasound showing an intrauterine mass. UAE was performed after the failure of conservative management and based on a multidisciplinary consensus.

Conclusions

1. High technical and clinical success:
Selective uterine artery embolisation (UAE) achieved flow arrest in all cases, with 89% of patients experiencing satisfactory improvement in symptoms following the procedure.

2. Minimal complications:
No periprocedural or early postprocedural complications were observed, highlighting the safety and effectiveness of UAE in treating postpartum hemorrhage due to placenta accreta spectrum (PAS) disorders.

Selective uterine artery embolization (UAE) is a safe and effective treatment for postpartum hemorrhage due to placenta accreta spectrum (PAS) disorders, with high technical success and minimal complications.

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INTRODUCTION

Postpartum haemorrhage is the most common cause of mortality among women after childbirth, with an average of 6 deaths per 100,000 births[1]. One percent of these cases is caused by the placenta abnormally invading the uterine wall[2]. Placenta accreta spectrum (PAS) disorders can be divided into three types according to the degree of penetration of the placental villi into the uterine wall: placenta accreta, increta, and percreta[3]. The incidence of PAS disorders is approximately 0.13‰ (ref.[4]) worldwide (i.e., approximately 1/8,000 births).

Risk factors include surgical scar (previous gynaecological surgeries – especially caesarean section, curettage, myomectomy, endometrial resection), nonsurgical scar (in vitro fertilization-IVF procedures, chemotherapy and radiation, endometritis, intra-uterine device, manual removal of placenta, placenta praevia), uterine abnormalities (bicornuate uterus, adenomyosis, submucous fibroids), and placenta praevia[5].

Retained products of conception (RPOC) and PAS are two main known causes of postpartum haemorrhage. While it was noted that patients who had hypervascular RPOC by histopathological confirmation had PAS (ref.[6]).

Ultrasound findings suggestive of PAS include placental lacunae, myometrial thinning to less than 1 mm, loss of a placental-uterine interface, and an abnormal uterine-bladder interface[7]. Postpartum residuals caused by PAS disorders are very often associated with significant vascularisation of the placental tissue and adjacent myometrium. Medical treatment alone is often insufficient for many reasons. One reason is the inability of the drug to penetrate the capillaries of the myometrium during umbilical venous injection, another reason may be insufficient differentiation of pathologies leading to placental retention[8]. Surgical solutions are very limited. Performing hysteroscopic ablation or evacuation of the residues using a curette is associated with a high risk of heavy bleeding during the procedure and the necessity of performing hysterectomy[9]. In a symptomatic patient (bleeding), after the failure of expectant management, a combination of selective embolisation of the uterine arteries with a subsequent attempt to surgically remove residues is presumably the optimal method.

Selective embolisation of uterine arteries was first described in 1979 by Brown in the post-adjuvant treatment of postpartum haemorrhage after previous peripartum hysterectomy[10]. The first described uterine arteries embolisation (UAE) due to an abnormally adherent placenta was performed several years later in 1993 (ref.[11]). The decision for endovascular treatment should be made after a multidisciplinary consensus based on sonographically confirmed residual placental tissue with signs of abnormal uterine wall invasion with aberrant hypervascularisation on Doppler US examination. CT angiography is mainly reserved for the exclusion of other (extrauterine) sources of bleeding. MRI diagnostics is used for antenatal diagnosis, not in the acute phase. In almost half of the patients, an abnormally invasive placenta is still diagnosed clinically during labour itself[12]. The aim of our work is to evaluate the effectiveness and safety of UAE in symptomatic patients with PAS disorders.

MATERIAL AND METHODS

This article presents an evaluation of the results of a group of eight patients between the age of 19–39 years who underwent selective transarterial embolisation of the uterine arteries at the angio-interventional department at our university hospital center from January 2022 to August 2023. In all patients from our group, the course

Fig. 1. Pelvic angiography using a pigtail catheter inserted from the right femoral artery showing a noticeable hypervascularised intrauterine mass dominantly supplied from the right uterine artery.

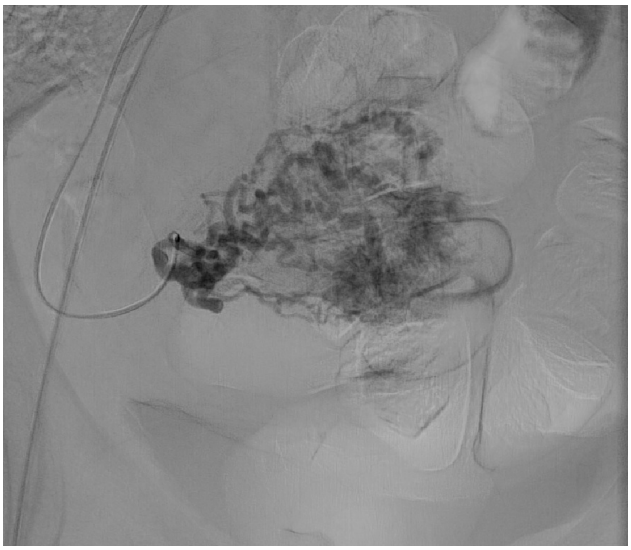

Fig. 2. Selective angiography of the right uterine artery through a microcatheter.

of puerperium was complicated by light bleeding (3/4 pads a day), and in one patient, it was complicated by life-threatening bleeding immediately after delivery with the need for hospitalization in the intensive care unit (ICU). After performing a complete gynaecological examination to confirm the intrauterine source of bleeding, all patients underwent transabdominal and transvaginal ultrasound with the evidence of an intrauterine echogenic mass invading the uterine wall. In all patients, endovascular therapy was used only after the failure of conservative treatment based on the decision of a multidisciplinary council.

Preparation before the actual procedure included preventive administration of broad-spectrum antibiotics (ampicillin-sulbactam, Unasyn, 3 g) in one dose at least thirty minutes prior. All procedures were performed under local anaesthesia in a dedicated angio suite equipped by Allura Xper FD20 (Philips Healthcare, Amsterdam, The Netherlands). The procedure began with performing a pelvic angiography using a 5 F pigtail catheter (Cook Medical, USA), inserted through the right femoral artery with the identification of hypertrophic uterine arteries supplying the intrauterine mass (Fig. 1).

The pelvic angiography was followed by the introduction of a 6 F sheath (or crossover sheath) and probing of the internal iliac artery with a 4–5 F catheter (e.g., RIM, RUC; Cook Medical, USA), followed by selective catheterization of the uterine artery with a microcatheter (2.4 F Direxion, Boston Scientific, USA) (Fig. 2).

Based on the angiographic findings, embolisation of the uterine artery until complete flow stasis was performed (Fig. 3).

The choice of embolisation agent depends on the vascular architecture of the lesion. In the case of smaller areas of tissue, polyvinyl alcohol embolisation particles (PVA, Boston Scientific, USA) of the size 250–700 microns for distal occlusion were used. When detecting wide supplying arteries (Fig. 4 a–c), embolisation was performed with PVA particles in combination with gelatine foam (Spongostan, Ethicon Inc., USA). During the embolisation procedure, dose area product (DAP) was measured in all patients.

Fig. 3. Fluoroscopic image of a right uterine artery embolisation by microcatheter using polyvinyl alcohol embolisation microparticles (PVA) until a flow stasis.

RESULTS

Thus far, in our angio-interventional department, we have performed uterine embolisation in eight patients (between the ages of 19–39 years) with abnormal vaginal bleeding with proven placental remnants in PAS disorders.

Demographic data and the interval between birth and embolisation, technique of embolisation, and DAP are summarized in Table 1.

The technical success of embolisation defined by flow arrest of the supplying arteries on control angiography was achieved in all performed procedures. Clinical success defined by satisfactory improvement of the presenting symptoms was 89%.

In our group, in two out of eight patients, an obvious unilateral arterial supply was identified, and only unilateral uterine artery embolisation was performed. Bilateral

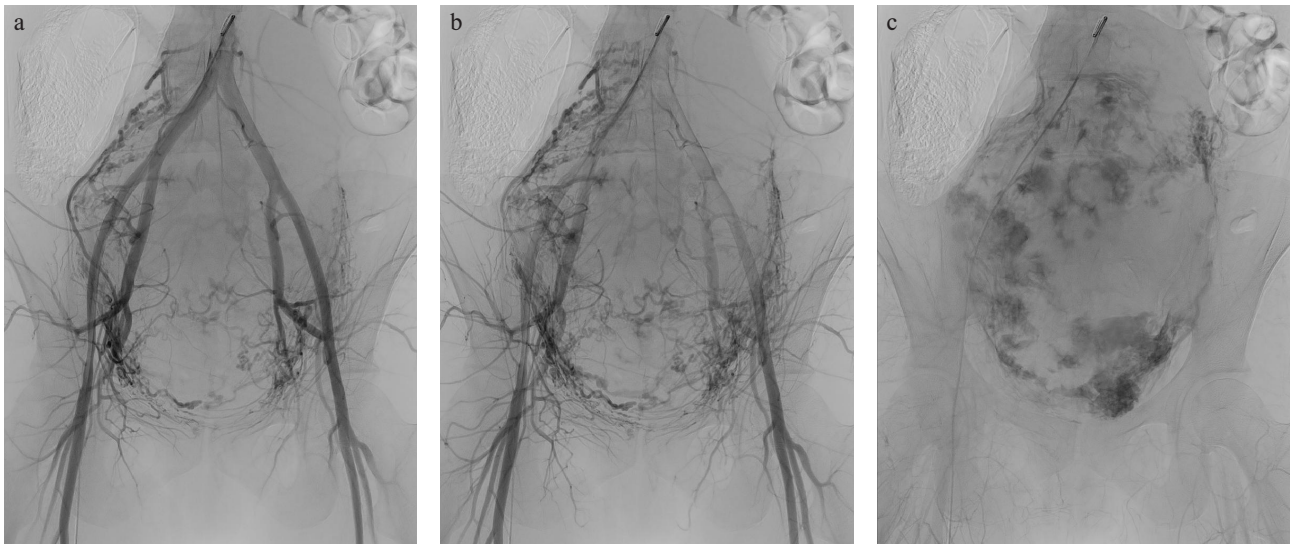

Fig. 4a–c. Pelvic angiography in a patient with placenta percreta revealing large hypervascularised invasive intrauterine masses.

Table 1. Demographic data and the interval between birth and embolisation, technique of embolisation and DAP.

Patients	Age	Time between birth and embolisation	Uni-/bilateral embolisation	Embolisation agent	DAP
Patient 1	29	43 days	bilateral	PVA (polyvinyl alcohol embolization particles)	42.8 Gy/cm^2
Patient 2	35	24 days	bilateral	PVA + gelatin foam	79.2 Gy/cm^2
Patient 3	38	46 days	unilateral	PVA	6.4 Gy/cm^2
Patient 4	37	75 days	unilateral	PVA + gelatin foam	18.0 Gy/cm^2
Patient 5	36	56 days	bilateral	PVA + gelatin foam	48.1 Gy/cm^2
Patient 6	36	58 days	bilateral	PVA	34.0 Gy/cm^2
Patient 7	39	59 days	bilateral	PVA + gelatin foam	17.2 Gy/cm^2
Patient 8	27	1 day	bilateral	gelatin foam	44.6 Gy/cm^2
Median	36	51 days			39.3 Gy/cm^2

embolisation was performed in the remaining six patients. In one patient, the suspicion of PAS disorder on the ultrasound was proven intraoperatively, yet without invasion into the surrounding organs. Due to the high risk of postresection bleeding in this patient, preoperative bilateral embolisation of the uterine arteries with subsequent surgical revision followed.

No periprocedural complications nor early postprocedural complications were noted. In three patients (one mentioned above), the embolisation was followed by planned hysteroscopic revision with removal of devascularised remnants of the placenta.

During follow-up in the obstetrics and gynaecology clinic, there was no recurrence of bleeding detected (interval 7–264 days, median 88 days after uterine artery embolisation). Median DAP after the treatment in our group of patients was 39.3 Gycm^2.

DISCUSSION

Among the risk factors for the development of PAS disorders are previous surgical or nonsurgical scars, uterine abnormalities, and placenta praevia. Due to the ever-increasing volume of caesarean sections performed worldwide (the global average in 2018 was 21.1%, with a prediction of approximately 28.5% by 2030) (ref.[13]), the incidence of postpartum haemorrhage in these patients is also increasing, as is the number of possible endovascular procedures.

The dominant symptoms of PAS disorders with remnants after delivery are abdominal pain and prolonged, in some cases even life-threatening, postpartum bleeding.

During the embolisation itself, knowledge regarding the anatomical variants of the origin of the uterine arteries is necessary, in addition to consideration of possible anastomoses with the ovarian arteries. Although some groups found that approximately 50% of patients had an identifiable anastomosis between at least one ovarian artery and uterine artery[14], some authors found a complete lack of a relationship between the presence of uterine-ovarian anastomosis and ovarian function and outcomes of UAE (ref.[15]). In the case of an unclear finding with complex vascular architecture on pelvic angiography, 3D angiography can be performed, which can also be used to identify collateral flow. Alternatively, it is possible to perform a cone beam CT to check the results of embolisation, where in the case of incomplete arterial occlusion, we would demonstrate the retention of the contrast agent due to the persistent supply of placental residue[16,17].

The uterine artery originates as a separate branch of the internal iliac artery or from the trifurcation together with the superior and inferior gluteal arteries. Anastomoses with rectal, iliolumbar, lumbar, or mesenteric arteries are less frequent, which in the latter case can result in mesenteric ischaemia. A wide range of embolisation agents can be used, we primarily used PVA particles alone or in combination with fibrin foam (especially in the case of large supplying arteries).

In the case of simultaneously detected increased serum values of β-hCG above 25 mlU/mL, transarterial chemoembolisation (TACE) could be performed with the use of dactinomycin (500 μg), which has, in addition to devascularisation, a cytotoxic effect on the placental residue. A lower risk of repeated bleeding through the destruction of active trophoblastic tissue is reported as a benefit of chemoembolisation[18].

According to a meta-analysis including over 8000 patients after UAE, major complications defined as those requiring prolongation of inpatient hospital stay (>48 hours) occurred in 2.9% of the patients[19]. In general, the fertility rate in patients after previous UAE is approximately 70–80% (ref.[20]).

Our results showed that endovascular treatment of postpartum haemorrhage in patients with PAS disorders is not only effective but also has a high rate of clinical success and a minimal incidence of postprocedural complications. Clear recommendations are not yet available, and therefore, the indication for UAE should be further investigated in larger prospective studies[21]. Median DAP after the treatment in our group of patients was 39.3 Gycm^2. In other foreign studies, median DAP of 196 Gycm (ref.[22]) was reported, which is approximately five times higher than the radiation exposure value in our group. For example, compared to UAE for the treatment of symptomatic uterine fibroids and/or adenomyosis, our results represent half the average published radiation dose[23]. The low radiation dose in our cohort is explained by current modern angiographic equipment and superselective embolisation technique.

CONCLUSION

Selective embolisation of the uterine arteries in patients with PAS disorders is a solution for symptomatic patients and patients in whom there is no regression of findings during the expectant management. This procedure is relatively safe and technically non-demanding, reduces the need for surgical intervention, and significantly reduces the risk of repeated bleeding. The radiation dose is very low and acceptable with this procedure.

ABBREVIATIONS

PAS, placenta accreta spectrum; IVF, in vitro fertilization; RPOC, retained products of conception; CT, computed tomography; MRI, magnetic resonance imaging; UAE, uterine artery embolization; ICU, intensive care unit; RIM catheter, Rösch inferior mesenteric; RUC catheter, Roberts uterine; DAP, dose area product; PVA, polyvinyl alcohol particles; β-hCG, beta human chorionic gonadotropin hormone; TACE, transarterial chemoembolization.

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Conflict of interest statement: The authors declare that there are no conflicts of interest regarding the publication of this article.
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